

Application No. 10/825737 (Docket: CNTR.2210)
37 CFR 1.111 Amendment dated 07/17/2007
Reply to Office Action of 04/18/2007

REMARKS/ARGUMENTS

In the Office Action, the Examiner noted that claims 1-20 are pending in the application. The Examiner additionally stated that claims 1-20 are rejected. By this amendment, claims 1, 7, and 15 are amended. Hence, claims 1-20 are pending in the application.

Applicant hereby requests further examination and reconsideration of the application, in view of the foregoing amendments.

In the Specification

Applicant has amended the specification to secure a substantial correspondence between the claims amended herein and the remainder of the specification. No new matter is presented.

In the Claims

Rejections Under 35 U.S.C. §103(a)

The Examiner rejected claims 1-5, 7-13, and 15-18 under 35 U.S.C. 102(e) as being unpatentable over Mitchell et al., U.S. Patent No. 7,006,943 (hereinafter, "Mitchell") in view of Thomas et al., U.S. Patent No. 6,487,668 (hereinafter, "Thomas"). Applicant respectfully traverses the Examiner's rejections.

In regard to claims 1, 4, 5, 7, 10, 12, 13, 15, and 18, the Examiner remarked that Mitchell discloses a method and apparatus for using an on-board temperature sensor on an integrated circuit or a microprocessor. The Examiner referred Applicant to Figs. 1 and 4, and noted that the device comprises a microprocessor 101, 401, temperature sensor 103 providing on-die thermal monitoring to measure the temperature of the die, temperature limit registers 105, compare logic 107, and cooling device 109 or fan 405. The Examiner noted that Mitchell does not disclose a variable fan control signal directly coupled to an external fan, but that Thomas discloses a fan controller 58 directly coupled to the fan 60 in the same field of endeavor for the purpose of temperature control. The Examiner thus concluded that it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the apparatus of Mitchell with a directly coupled fan in view of Thomas so as to control the temperature.

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Applicant concedes that it is well known in the art that to achieve more accurate temperature measurements, it is desirable to provide a temperature sensor as near to a temperature measurement point as is practical.. Consequently, Applicant agrees substantially with the Examiner's characterization of the teaching of Mitchell because Mitchell's purpose is to provide a more accurate temperature measurement of an integrated circuit die and to provide appropriate logic on the same integrated circuit whose temperature is being measured to evaluate that temperature measurement and provide appropriate signals capable of being utilized to provide thermal control functions. (Abstract)

However, the above point is all that Mitchell provides, i.e., put a temperature sensor on an integrated circuit to allow for more accurate measurement. But none of the independent claims, as amended, recite such a limitation. Consequently, Mitchell's disclosure may be of use to those desiring a more accurate temperature measurement, but with regard to the problem that the present invention addresses, Mitchell is utterly silent. This is because Mitchell's assumption, and stated purpose, is to provide more accurate temperature measurements and commensurate signals that are capable of being utilized by off-die temperature control units.

Claim 1 as herein amended is repeated below for ease of reference:

1. A microprocessor with temperature control, comprising:
a microprocessor die with an external interface for externally providing a variable fan control signal; and
fan control logic, provided on said microprocessor die, that provides said variable fan control signal based on temperature information associated with the microprocessor, wherein said variable fan control signal is directly coupled to an external fan to directly control said external fan, and wherein said fan control signal is operative to variably control rotational speed of said external fan, and wherein said fan control logic adjusts operation of said external fan to achieve an optimum blend of reliability, power consumption, and speed of the microprocessor.

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It is respectfully noted that fan control logic is recited, which is provided on said microprocessor die, to provide a variable fan control signal based on temperature information associated with the microprocessor, wherein the variable fan control signal is directly coupled to an external fan to directly control the external fan, and wherein the fan control signal is operative to variably control rotational speed of said external fan, and wherein the fan control logic adjusts operation of the external fan to achieve an optimum blend of reliability, power consumption, and speed of the microprocessor.

Mitchell does not teach these elements and limitations. In addition, Applicant respectfully notes that fan control logic, as recited in claim 1, is provided to adjust operation of the external fan to achieve an optimum blend of reliability, power consumption, and speed of the microprocessor. These functions are more complex than simple temperature control.

Thomas indeed discloses a temperature-activated, variable-speed fan for temperature control of a microprocessor. However, it is noted that Thomas' fan controller is provided external to the microprocessor, and thus it is not contemplated to provide such an element on-die, thus resulting in the only consideration being that of temperature-based activation and control of a fan.

Thomas certainly does not disclose, or suggest any reason to provide fan control logic on die that adjusts operation of a fan to achieve an optimum blend of reliability, power consumption, and speed of a microprocessor. Thomas's stated purpose is to provide techniques for controlling a processor's clock frequency so as to prevent overheating and, in addition, to maximize processing speed of the processor. In addition, Thomas desires to conserve the amount of energy consumed by a processor. (Abstract) To achieve these objectives, Thomas's fan controller need no be provided on the same die and only performs a pulse-width modulation operation of the fan to allow the speed of the fan to be controlled without wasting energy. Thus, Thomas teaches a temperature-activated, variable-speed fan.

But in contrast to providing a temperature-activated, variable-speed fan, Applicant's fan control logic is on the same die and is configured to adjust operation of a fan to achieve

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an optimum blend of reliability, power consumption, and speed of a microprocessor. For instance, it is noted in the specification that even if the current temperature of the microprocessor 104 is within the desired range as determined at block 205, it may also be determined that the temperature is quickly increasing as a result of a recent increase in power level (e.g., increase in microprocessor clock speed and/or voltage) and that the fan 101 should be turned on or that its rotational speed should be increased (paragraph [0019]). Such a complex function of fan control is not alluded to or suggested by Mitchell or Thomas.

Fan control logic, as recited is not known or suggested by any of the cited references. Thus, it is not a known element. All of the references teach controlling a fan based solely upon temperature considerations. Applicant's invention, on the other hand, provides fan control logic that adjust operation of a fan to achieve an optimum blend of reliability, power consumption, and speed of a microprocessor.

Base upon the points put forth above, Applicant respectfully requests that the rejection of claim 1 be withdrawn.

In addition, it is noted that claims 7 and 15 recite substantially the same limitations as have been argued above in traversal of the rejection of claim 1. Accordingly, the Examiner is referred to the points set forth above in traversal of the rejection of claim 1, and it is requested that the rejections of claims 7 and 15 be withdrawn.

With respect to claims 2-5, these claims depend from claim 1 and add further limitations that are neither anticipated nor made obvious by Mitchell, Thomas, or a combination of Mitchell and Thomas. Accordingly, Applicant respectfully requests that the Examiner withdraw the rejections of claims 2-5.

With respect to claims 8-13, these claims depend from claim 7 and add further limitations that are neither anticipated nor made obvious by Mitchell, Thomas, or a combination of Mitchell and Thomas. Accordingly, Applicant respectfully requests that the Examiner withdraw the rejections of claims 8-13.

With respect to claims 16-18, these claims depend from claim 15 and add further limitations that are neither anticipated nor made obvious by Mitchell, Thomas, or a

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combination of Mitchell and Thomas.. Accordingly, Applicant respectfully requests that the Examiner withdraw the rejections of claims 16-18.

The Examiner also rejected claims 6, 14, 19, and 20, under 35 U.S.C. 103(a) as begin unpatentable over Mitchell in view of Thomas as applied to claims 1, 7, and 15, and further in view of Hussain et al. (U.S. Patent 6,172,611). Applicant respectfully traverses.

The Examiner pointed out that Mitchell/Thomas disclose the invention substantially as claimed, but that Mitchell/Thomas do not disclose and external temperature sensor in the system. However, the Examiner stated that Hussain discloses an external temperature sensor in the same field of endeavor for the purpose of providing information of external temperature (col.4, lines 18-27). The Examiner concluded that it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Mitchell/Thomas with an external temperature sensor in view of Hussain so as to supply environmental temperature.

Hussain teaches that the fan controller 150 is a brushless DC fan controller that is coupled to a brushless DC fan 160. Thus, Hussain does not teach fan control logic, provided on a microprocessor die, that provides a variable fan control signal based on temperature information associated with the microprocessor. Hussain does not contemplate that his brushless DC fan controller 150 could be anything other than a stand-alone device that controls the operation of a brushless DC fan 160 via coupling 152 in a manner known in the art at that time. (col. 5, lines 59-65) Without a doubt, Hussain does not disclose any suggestion that might motivate one skilled in the art to add or otherwise integrate his brushless DC fan controller within the die of a microprocessor. Therefore, he also fails to teach any form of fan control logic that is provided on a microprocessor die, that provides a variable fan control signal based on temperature information associated with the microprocessor. In addition, Hussain does not teach fan control logic that adjusts operation of an external fan to achieve an optimum blend of reliability, power consumption, and speed of a microprocessor.

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Consequently, in view of the above points and arguments set forth above in traversal of the rejections of claims 1, 7, and 15, and furthermore noting that claims 6, 14, 19, and 20 add further limitations over that subject matter which has been argued as being allowable, it is requested that the rejections of claims 6, 14, 19, and 20 be withdrawn.

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CONCLUSIONS

Applicant believes this to be a complete response to all of the issues raised in the instant office action and further submits, in view of the amendments and arguments advanced above, that claims 1-20 are in condition for allowance. Reconsideration of the rejections is requested, and allowance of the claims is solicited.

Applicant also notes that any amendments made by way of this response, and the observations contained herein, are made solely for the purpose of expediting the patent application process in a manner consistent with the PTO's Patent business Goals (PBG), 65 Fed. Reg. 54603 (September 8, 2000), and are furthermore made without prejudice to Applicant under this or any other jurisdictions. It is moreover asserted that insofar as any subject matter might otherwise be regarded as having been abandoned or effectively disclaimed by virtue of amendments made herein and/or incorporated in attachments submitted with this response, Applicants wishes to reserve the right and hereby provides notice of intent to restore such subject matter and/or file a continuation application in respect thereof.

Applicant earnestly requests that the Examiner contact the undersigned practitioner by telephone if the Examiner has any questions or suggestions concerning this amendment, the application, or allowance of any claims thereof.

I hereby certify under 37 CFR 1.8 that this correspondence is being facsimile transmitted to the United States Patent and Trademark Office on the date of signature shown below.
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Respectfully submitted,
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